IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant : Moshe Rock et al. Art Unit : 1771
Serial No. : 09/624,660 Examiner : Norca Liz Torres Velazquez
Filed : July 25, 2000
Title : PLAITED DOUBLE KNIT FABRIC WITH MOISTURE MANAGEMENT AND IMPROVED THERMAL INSULATION

Mail Stop Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

SUPPLEMENTAL BRIEF ON APPEAL

Appellants submits this supplemental appeal brief in response to the office action of September 22, 2004 (the "Office Action"). In that office action, the Examiner's final rejection dated January 28, 2004 was withdrawn and replaced by a nonfinal rejection on a new combination of the previously cited references. Appellants maintain that the pending claims are patentable and wishes to proceed directly to appeal.

(1) Real Party in Interest

Malden Mills Industries, Inc.

(2) Related Appeals and Interferences

There are no pending related appeals or interferences.

(3) Status of Claims

Claims 1-8 and 10-32 are pending. Claims 19-32 have been cancelled.

CERTIFICATE OF MAILING BY FIRST CLASS MAIL

I hereby certify under 37 CFR §1.8(a) that this correspondence is being deposited with the United States Postal Service as first class mail with sufficient postage on the date indicated below and is addressed to the Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

January 24, 2005
Date of Deposit

Linda M. White
Signature

Linda M. White
Typed or Printed Name of Person Signing Certificate

In an office action mailed Septemer 22, 2004:

Claims 1-8 and 10-18 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,312,667 to Lumb *et al.* ("Lumb") in view of Japanese Patent 09-087901A to Fujiwara *et al.* ("Fujiwara") and Japanese Patent 02-182968 to Toshio *et al.* ("Toshio").

(4) Status of Amendments

An amendment canceling claims 19-32 is submitted herewith.

(5) Summary of Claimed Subject Matter

Claims 1-8 and 10-18 all feature a composite textile fabric that includes an inner fabric layer and an outer fabric layer, which are formed concurrently by knitting a plaited construction. Both the inner fabric layer and outer fabric layer are made of yarns having a plurality of fibers of polyester or other synthetic yarn that have been rendered hydrophilic. The inner fabric layer has a surface area enlarged by a raising process that creates air spaces among the fibers, enhancing insulation performance and reducing contact of the inner fabric layer upon a wearer's skin. Particles of a refractory compound are embedded within the plurality of yarn fibers of the inner fabric layer.

(6) Grounds of Rejection

Claims 1-8 and 10-32 stand rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Lumb in view of Fujiwara and Toshio.

(7) Argument

The pending claims recite a fabric construction including refractory particles embedded within the yarn fibers of an inner fabric layer that has a surface area enlarged by a raising process. This creates air spaces among the fibers, enhancing insulation performance of the fabric, and also reducing contact of the inner fabric layer, and consequently the refractory particles embedded in the inner fabric layer, upon a wearer's skin.

The Examiner states that Lumb discloses a composite textile fabric for moving moisture away from the skin. Fujiwara is then provided for the disclosure of refractory particles

embedded within a fabric. Finally, the Examiner relies on Toshio to provide a disclosure of a fabric construction that reduces the contact of the inner fabric layer upon a wearer's skin.

As noted in Appellants' Appeal Brief mailed June 25, 2004, the fabric in Fujiwara is a very thin stocking fabric where the entire fabric body is in close proximity to the skin. (See Appellant's Appeal Brief mailed June 25, 2004, p. 3, second full paragraph.) Accordingly, the combination of Lumb with Fujiwara does not teach or suggest a fabric construction as recited in the pending claims, which provides a fabric constructed such that contact of the skin with the refractory particles is reduced.

Thus, while the Examiner does not expressly state this, it appears that the Examiner has construed Toshio to teach or suggest a fabric construction where the inner fabric layer has reduced contact with the skin wearer's skin, as recited in the pending claims. In an effort to support this interpretation, the Examiner quotes the following text from a machine translation provided by the Examiner:

> In particular, when knitted and woven fabric in which moisture-absorbing fibers such as cotton and wool are used as pile yarns and a binder containing far-infrared radioactive inorganic particles is given to the hair tips of the pile yarns are worn while placing said hair tip part toward the side opposite to the human body, the human body is effectively kept warm, and the blood vessels are expanded by the permeation of far-infrared rays into the deep skin part, so that the blood circulation is improved. (See Toshio, paragraph bridging pages 13 and 14.)

The Examiner appears to be construing the term "opposite" in this passage to mean that the "hair tip part" is on the side of the fabric that is opposite the wearer (i.e., on the outside surface of the fabric), and thus that the hair tip part has reduced contact with the wearer's skin. Appellants respectfully disagree with this interpretation. Appellants have obtained a certified translation of Toshio (Exhibit A, attached herewith), and have found that the same passage in the certified translation reads very differently. In the certified translation, the tips of the pile yarn are explicitly described as being *in contact with* the wearer's body. The relevant portion is reproduced below:

> In particular, if absorbent fibers like cotton or wool are used as the pile yarn and binder containing inorganic granules with far-infrared radiation characteristics is affixed to the tips of the pile yarn, then, *when those fiber*

> *tips are worn so that they come into contact with the body, they have a especially good heat retaining effect.* The far-infrared radiation penetrates to the deepest areas of the skin and extends to the blood vessels, improving blood flow, so the warming effect is not merely local, but warms the entire body. (Exhibit A, p. 458, last full paragraph. *Emphasis added.*)

As can be seen in the passage from the certified translation, Toshio discloses a fabric construction in which the refractory particles are in direct contact with the skin of the wearer.

Moreover, the interpretation that is supported by the certified translation (that the fiber tips are in contact with the body) is more sensible than the interpretation suggested by the Examiner. Stated differently, how could far-infrared radiation penetrate the deepest areas of the skin (as stated in both translations) if the tips of the pile yarn were positioned away from the skin of the wearer?

Because both Fujiwara and Toshio disclose refractory particles positioned in close proximity to a user's skin, nothing in the prior art of record would have led the artisan to modify Lumb to provide a product having refractory particles positioned for reduced contact with a user's skin. Absent such a suggestion, a *prima facie* case of obviousness has not been made. Instead, the Examiner is improperly relying on hindsight reconstruction of the references to deprecate the invention. (See, e.g., *In re Fine*, 837 F.2d 1071, 1075 (Fed. Cir. 1988).) For at least these reasons, Appellants submit that the rejection should be reversed and the Application be allowed.

The brief fee of $500 is enclosed. Please apply any other charges or credits to Deposit Account No. 06-1050.

Respectfully submitted,

Date: January 24, 2005

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Appendix of Claims

1. A composite textile fabric comprising an inner fabric layer made of a yarn comprising a plurality of fibers of polyester or other synthetic yarn which have been rendered hydrophilic, and an outer fabric layer made of a yarn comprising a plurality of fibers of polyester or other synthetic yarn which have also been rendered hydrophilic;

wherein the inner fabric layer and outer fabric layer are formed concurrently by knitting a plaited construction;

wherein particles of a refractory compound are embedded within said plurality of yarn fibers of said inner fabric layer; and

wherein said inner fabric layer has a surface area enlarged by a raising process for creating air spaces to enhance insulation performance and for reducing contact of the inner fabric layer upon a wearer's skin.

2. The textile fabric of Claim 1, wherein said other synthetic yarn of each of said fabric layers is selected from the group consisting of acrylic, polypropylene and nylon.

3. The textile fabric of Claim 1, wherein the denier ratio of the yarn fibers of the inner fabric layer is at least as great as the denier of the yarn fibers of the outer fabric layer.

4. The textile fabric of Claim 1, wherein the denier of the yarn of the inner fabric layer is no greater than the denier of the yarn of the outer fabric layer.

5. The textile fabric of Claim 1, wherein the denier of the yarn fibers of the inner fabric layer is at least as great as the denier of the yarn fibers of the outer fabric layer and the denier of the yarn of the inner fabric layer is no greater than the denier of the yarn of the outer fabric layer.

6. The textile fabric of Claim 4, wherein the yarn fibers of the inner fabric layer have a denier of between about 0.7 and 6.0 and the yarn fibers of the outer fabric layer have a denier of between about 0.3 and 2.5.

7. The textile fabric of Claim 5, wherein the yarn of the outer fabric layer has a denier between about 100 and 300 and the yarn of the inner fabric layer has a denier of between about 50 and 150.

8. The textile fabric of Claim 1, wherein said compound is selected from the group consisting of titanium carbide, zirconium carbide and hafnium carbide.

10. The textile fabric of Claim 1, wherein the yarn of the inner layer is a small denier filament yarn.

11. The textile fabric of Claim 1, wherein the yarn of the outer fabric layer is spun, multifilament or a combination thereof.

12. The textile fabric of Claim 11, wherein the yarn fibers of the outer fabric layer are air jet spun.

13. The textile fabric of Claim 1, wherein said fabric is selected from the group comprising two-end fleece, three-end fleece, terry with regular plaiting, double terry, tricot, single knit jersey and double knit jersey fabrics.

14. The textile fabric of Claim 1, wherein each of said layers has an elastomeric yarn plaited therein.

15. The textile fabric of Claim 1, wherein the fabric has a weight per unit area of between about 2 ounces/yard^2 and 20 ounces/yard^2.

16. The textile fabric of Claim 1, wherein the yarn fibers of the outer fabric layer are more hydrophilic than the yarn fibers of the inner fabric layer.

17. The textile fabric of Claim 1, wherein the outer fabric layer includes yarn fibers made of cotton or other absorbent fibers that are blended with the yarn fibers made of a polyester or other synthetic material.

18. The textile fabric of Claim 1, wherein said inner fabric layer has a surface area that is enlarged by a raising process selected from the group consisting of sanding, napping and brushing.

19-32. (Cancelled)

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Certificate of Accuracy

This is to certify that the attached document, Japanese Patent H02-182968, originally written in Japanese is, to the best of our knowledge and belief, a true, accurate and complete translation into English.

Dated: December 14, 2004

Ashley L. Schroeder
Legal Team Manager, Translations
Merrill Corporation

Sworn to and signed before
Me this 14th day of
December 2004

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(54) Title of the Invention: MANUFACTURING METHOD FOR KNITTED/WOVEN PILE WITH SUPERIOR HEAT RETENTION

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Specification

1. Title of the Invention: MANUFACTURING METHOD FOR KNITTED/WOVEN PILE WITH SUPERIOR HEAT RETENTION

2. Claims

Claim 1. A method for manufacturing knitted/woven pile with superior heat retention with the following features: The tips of the fibers in a knitted/woven pile are fully napped and opened, after which a binder containing inorganic granules that have far-infrared radiation characteristics are atomized and affixed to the tips.

Claim 2. The method for manufacturing knitted/woven pile with superior heat retention described in Claim 1 in which the pile contains 1 or 2 or more inorganic powders that have far-infrared radiation characteristics from among the following: zirconium oxide, cobalt oxide, iron oxide, manganese oxide, copper oxide, titanium oxide, silica oxide, silica carbide, chrome oxide, or aluminum oxide.

3. Detailed Description of the Invention

Industrial Fields of the Invention

This invention pertains to methods for affixing inorganic granules with far-infrared radiation characteristics to the tips of the fibers in knitted/woven pile.

Prior Art

Knitted/woven pile is generally made from natural fibers, such as cotton or wool or from synthetic fibers such as acrylic or polyester. Normally, good heat retention characteristics are important with knitted/woven pile of this sort, which can be improved by lengthening the pile or by increasing its density, for example. In particular, attempts have been made to improve heat retention characteristics by blending in higher rates of wool with excellent heat retention, but there are limits to the extent to which heat retention can be improved. Special techniques are required to go beyond these limits.

In other areas, such as thermal physical therapy, it is known that inorganic granules, with far-infrared radiation characteristics, can be affixed to clothing for the purpose retaining heat. However, no such technique is known for affixing inorganic granules to knitted/woven pile. In particular, there is no known method for affixing them to the tips of the fibers in knitted/woven pile.

Problems that the Invention Attempts to Solve

However, inorganic granules with far-infrared radiation characteristics are like sand and have poor adhesion. It is not easy to affix them, uniformly and securely, to just the tips of the fibers in knitted/woven pile.

This invention solves these problems. By wearing the resulting knitted/woven pile, to which inorganic

granules with far-infrared radiation characteristics have been affixed, superior heat retention and therapeutic effect are achieved.

Means for Resolving the Problems

In order to achieve the above objectives with this invention, the tips of the fibers in the knitted/woven pile are napped and fully exposed, after which a binder, containing inorganic granules with far-infrared radiation characteristics, is atomized onto the tips of the fibers in question.

Material that is suitable for use in this knitted/woven pile includes natural fibers, such as cotton or wool, and synthetic fibers like acrylic or polyester. Alternatively, mixes or blends of these materials could be used, but considering heat retention and comfort, wool or cotton would be desirable for their moisture absorption characteristics. There are no particular limitations on the way the knitted/woven pile can be knitted/woven together, and the pile could have loops or be an open weave.

Inorganic granules with far-infrared radiation characteristics that can be used in this invention include ceramic granules that radiate far-infrared radiation at wavelengths of 4 – 25 microns, which have the best efficiency for retaining heat around human body temperature. These include one or more of the following: cobalt oxides, iron oxides, zirconium oxides, manganese oxides, copper oxides, silicon oxides, titanium oxides, chrome oxides, aluminum oxides and silicon carbides. These inorganic granules are also used as sintered bodies in Bakelite, Cordierite, Murite and clay. The granularity of these inorganic granules should be between 0.1 and 30 microns.

Additionally, these inorganic granules are also used with binders. Candidate binders include those that have a soft texture or appearance and excellent adhesion to the knitted/woven pile. These include urethane elastomer resins and ester acrylate resins, which are dissolved in toluene or a similar solvent. These are then emulsified in water and diluted before use.

When atomizing the binders containing the inorganic granules described above, it is necessary that the surface of knitted/woven pile be fully open, especially at the tips of the fibers. Next, the binder with the inorganic granules and the far-infrared radiation characteristics described above is affixed to the knitted pile in question by atomizing it. When doing so, it is desirable to keep the tips of the fibers from adhering to each other.

After atomizing the binder, the knitted/woven pile described above could be treated with an atomized lubricant such as amino-denatured silicon resin oil, if necessary, to improve suppleness. Later, the fibers could be subjected to such processes as napping, polishing, or trimming.

Additionally, if necessary, the binder with the inorganic granules described above could also be affixed to the reverse side of the knitted/woven pile. This could involve atomization or normal glue backing application techniques.

Figures 1 and 2 show examples of magnified cross-sections of the structure of the resulting knitted/woven pile, to which inorganic granules with far-infrared radiation characteristics have been affixed. Figure 1 shows the warp yarn (1) and the weft yarn (2), which form the base structure and into which the pile fibers (3) have been inserted. Binder (5), containing inorganic granules with far-infrared radiation characteristics, has been affixed to the tips (4) of those fibers.

Additionally, in Figure 2, as in Figure 1, binder (5), containing inorganic granules with far-infrared radiation characteristics, has been affixed to the tips (4) of the pile fibers (3) and a binder layer (6), containing inorganic granules with far-infrared radiation characteristics has also been applied to the base structure.

Below we will explain this invention further using embodiments.

Embodiments

Embodiment 1

In a dual-sided woven wool pile sample, 100% (2/52) acrylic fiber was used as the warp yarn in the base while 100% (30/2) polyester fiber was used in the weft yarn in the base and in the pull warp yarn. The pile yarn was 100% (2/32) shrink-resistant wool. The twist factor, α, was 67, the yarn had an over-under ratio of 55%, the pile length was 6 mm on the front and 6.5 mm on the back and the needling density was 50 lines per inch. The base warp yarn was fed through a dropper only on the lower part and the pile yarn passed through a drive roller and an auxiliary roller before going through a separation spindle, dropper and holder, before being supplied to a dual-weave module where it was woven into a 10-division format. The pile yarn that is passed over to the woven base above and below is trimmed at the center, producing a two-layer woven pile. The weight of this fabric is 864 g/m. By pulling the loose warp yarn on the reverse side of this fabric through, the pile is exposed, resulting in a two-sided woven pile. Using a Wince dying device on this

woven fabric, we dyed the wool a beige color using an acid dye, softened it and dried it in a tumble dryer. Subsequently, we napped the fibers on the front and rear surfaces and increased the surface area of the pile using an open weave.

Meanwhile, we subjected a mixture of metal oxides (60% MnO_2, 20% Fe_2O_3, 10% CuO and 10% CoO) to preliminary sintering at 1200° C. We then mixed this partly sintered mixture (30%) with Cordierite and sintered it at 1150° C, after which we pulverized it into a fine powder of 1 – 20 microns. We then mixed 15% of this inorganic powder with 30% urethane resin, 15% ester acrylate resin and 40% water and stirred it to produce our base processing solution.

We added water at a rate of 1:1 to this base solution and, after diffusing and mixing it, we atomized it over the surface of the woven pile at a rate of 200 g/M (apparent amount) and sized on a tenter before drying it. We then processed the reverse side of the woven pile in the same manner as above and napped and trimmed the fibers on the front and back of this fabric, producing a two-sided wool blanket. In addition to the heat retention characteristics of the wool that made up the majority of this two-sided wool blanket, we found an improvement in the sensation of warmth, created by the far-infrared radiation characteristics of the inorganic powder that had been affixed, as well increased blood flow.

Embodiment 2

We used acrylic fiber (1/14) as the pile yarn, acrylic fiber (1/52) as the base yarn and, with a 16G seal flice machine, we drew out 38 mm and knitted the knit base for the pile with the setting at 13. We then napped and opened the fibers in the pile surface.

Meanwhile, as with Embodiment 1, we made our base solution by combining and stirring 15% powder, 30% urethane resin, 10% toluene, 20% ester acrylate and 25% water. One part of this base solution was mixed with 1.5 parts ester acrylate resin, and 1 part water, stirred and applied to the surface of the pile at the knitted base using a nozzle and a rate of 300 g/m (apparent amount). This was sized on a tenter and dried. We napped the fibers of this fabric and ran a polisher over it 4 times in a temperature range of 100 – 140° C. We then trimmed and finished the tips of the fibers. The result was knitted pile that weighed 450 g/m. We used this fabric to make a vest and insoles for shoes. The vest worked well as a heat-retaining vest. In other words, depending upon the body temperature, the inorganic granules would be warmed and radiate far-infrared radiation, improving the heat-retaining effect. Additionally, the effect of the inorganic granules with far-infrared radiation characteristics in shoe insoles to produce a clean fresh feeling without making the feet sweaty.

Embodiment 3

We used a bulky yarn as our pile yarn that was acrylic (2/32) fiber, an acrylic (1/52) fiber as the base yarn and a polyester (150d) processed yarn as the alignment yarn, we drew out 19 mm and knitted the fabric on a seal flice machine with the setting at 12.

Meanwhile, as with Embodiment 1, we made our base solution by combining and stirring 20% powder, 35% urethane resin, 10% toluene, 10% ester acrylate and 35% water. One part of this base solution was mixed with 1 part ester acrylate resin, and 1 part water, stirred and atomized onto the rear knitted surface at a rate of 300 g/m (apparent amount). This was then sized on a tenter and dried. After napping and finishing the fibers in the pile of this fabric sufficiently, we then combined 2 parts water to 1 part of the inorganic granule base solution described above and stirred them. We then atomized the solution on the front surface of the knitted pile at a rate of 300 g/m (apparent amount) and sized it on a tenter for drying. We re-napped and finished the pile on this fabric and then trimmed the tips of the pile fibers. This cloth was used to make a heat-retaining vest. The effect was that the inorganic granule powder with the far-infrared radiation characteristics was heated by the temperature of the body. We then finished the fibers again and dried the knitted pile in a tumble dryer. Used as a fleece insole for shoes, it kept the shoes comfortably dry and fresh.

Embodiment 4

As in Embodiment 1, we used a pre-dyed cotton yarn (30/2) in the pile fiber, cotton yarn in the base warp (40/2) and 100% polyester (40/2) in the base weft. We created a two-sided woven pile that had 22 rows, 12 divisions, a pile length of 3 m/m and a drive density of 62 units per inch. This weight of this fabric was 669 g/m.

Meanwhile, we made a base solution that emitted far-infrared radiation as with Embodiment 1, by combining and stirring 15% powder, 30% urethane resin, 15% ester acrylate and 40% water.

We stirred together 1 part of this base solution with 1 part ester acrylate resin and 1 part water and then atomized it onto the front and rear surfaces of the two-sided woven pile described above (before the weft yarn was pulled out) at a rate of 300 g/m (apparent amount) and then dried.

Subsequently, by pulling out 4 of the 12 polyester (40/2) lengths of weft yarn in the back of the atomized, two-sided, woven pile, we pulled the front side pile out to the back side.

The inorganic granules that emit far-infrared radiation were left where they had been affixed to the base yarn on either side of the front and back pile cotton, in the form of a sandwich. We napped, trimmed and finished the napping of these front and rear pile surfaces. We cut the finished bolt to 200 cm, producing a two-sided 100% cotton blanket. We found that the far-infrared radiation of the inorganic granules in this blanket, improved feelings of warmth and helped to make the blood circulate.

Effect of the Invention

As described above, this invention makes it possible to easily affix, uniformly and securely, inorganic granules, that have far-infrared radiation characteristics, to the tips of the pile fibers of any kind of knitted/woven fiber made of natural fiber, recycled fiber or synthetic fiber.

The resulting knitted/woven pile to which the inorganic granule with the far-infrared radiation characteristics have been affixed, could be used as linings in vests or coats, mats to prevent slipping, insoles, hot carpet covers or in similar goods. Because bedding and sheets can be given a uniform softness, it would be worthwhile to use it in two-sided blankets or other interior linen/bedding.

In particular, if absorbent fibers like cotton or wool are used as the pile yarn and binder containing inorganic granules with far-infrared radiation characteristics is affixed to the tips of the pile yarn, then, when those fiber tips are worn so that they come into contact with the body, they have a especially good heat retaining effect. The far-infrared radiation penetrates to the deepest areas of the skin and extends to the blood vessels, improving blood flow, so the warming effect is not merely local, but warms the entire body. Additionally, sweat or other moisture from the body's surface could pass through the water-dispersible binder to be absorbed by the fibers deep within the pile. This would give the part that comes into contact with the skin refreshing and very comfortable.

4. Brief Description of the Drawings

Figures 1 and 2 show enlarged cross sections of the structure of the knitted/woven pile produced using the methods of this invention.

1. Warp 2. Weft 3. Pile Yarn
4. Fiber Tips 5. Binder
6. Knitted/Woven Front/Rear Binder Layers

Patent Applicant: Toyo Kosan Co., Ltd.
Patent Applicant: Aono Pile Co., Ltd.

Figure 1

[see original for drawing]

Figure 2

[see original for drawing]